



[7590-01-P]

NUCLEAR REGULATORY COMMISSION

[Docket Nos. 50-338, 50-339, 72-56, and 72-1030; NRC-2012-0084]

Virginia Electric and Power Company

North Anna Power Station Units 1 and 2

Independent Spent Fuel Storage Installation; Exemption

1.0 BACKGROUND

Virginia Electric and Power Company (Dominion, the licensee) is the holder of Facility Operating License Nos. NPF-4 and NPF-7, which authorize operation of the North Anna Power Station Units 1 and 2 in Louisa County, Virginia, pursuant to Title 10 of the *Code of Federal Regulations* (10 CFR), Part 50. The licenses provide, among other things, that the facility is subject to all rules, regulations, and orders of the U.S. Nuclear Regulatory Commission (NRC or the Commission) now or hereafter in effect.

Pursuant to 10 CFR Part 72, Subpart K, a general license is issued for the storage of spent fuel in an independent spent fuel storage installation (ISFSI) at power reactor sites to persons authorized to possess or operate nuclear power reactors under 10 CFR Part 50. Dominion is authorized to operate a nuclear power reactor under 10 CFR Part 50, and holds a 10 CFR Part 72 general license for storage of spent fuel at the North Anna Power Station ISFSI. Under the terms of its general license, Dominion loaded spent fuel using the Transnuclear, Inc, (TN) NUHOMS® HD Storage System (HD-32PTH) dry cask storage system (Certificate of Compliance (CoC) No. 1030, Amendment No. 0) at the North Anna Power Station ISFSI.

2.0 REQUEST/ACTION

The TN NUHOMS® HD dry cask storage system is designed for zone loading based on decay heat. CoC 1030 specifies requirements, conditions, and operating limits of the dry shielded canisters (DSCs) in Appendix A of the Technical Specifications (TS). The TS restrict the decay heat in lower Zone 1a locations to < 1.05 kW and the upper Zone 1b locations to ≤ 0.8 kW. The licensee inadvertently reversed the upper and lower zones while preparing the DSC loading maps. This resulted in twelve fuel assemblies being loaded into seven DSCs with decay heat greater than the limits specified in the CoC. The seven DSCs are designated with serial numbers DOM-32PTH-004-C, -005-C, -007-C, -010-C, -013-C, -019-C and GBC-32PTH-011-C.

In a letter dated July 21, 2011, as supplemented September 28, 2011 (Agencywide Documents Access and Management System (ADAMS) Accession Nos. ML11208C453 and ML11286A143, respectively), Dominion requested a one-time exemption from the following requirements to allow storage of the seven DSCs, with serial numbers DOM-32PTH-004-C, -005-C, -007-C, -010-C, -013-C, -019-C and GBC-32PTH-011-C, in their current, as-loaded, condition at the North Anna Power Station ISFSI:

- 10 CFR 72.212(b)(3), which states the general licensee must “[e]nsure that each cask used by the general licensee conforms to the terms, conditions, and specifications of a CoC or an amended CoC listed in § 72.214.”
- The portion of 10 CFR 72.212(b)(11), which states that “[t]he licensee shall comply with the terms, conditions, and specifications of the CoC...”

3.0 DISCUSSION

Pursuant to 10 CFR 72.7, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of the regulations of 10 CFR Part 72 as it determines are authorized by law and will not endanger life or property or the common defense and security and are otherwise in the public interest.

Authorized by Law

This exemption would allow the licensee to continue to store seven DSCs (loaded with spent nuclear fuel assemblies having decay heat exceeding the limits required by CoC No. 1030, Amendment No. 0, at the time of loading) in their as-loaded configuration at the North Anna Power Station ISFSI. The provisions in 10 CFR Part 72 from which Dominion is requesting an exemption, require the licensee to comply with the terms, conditions, and specifications of the CoC for the approved cask model that it uses.

The Commission issued 10 CFR 72.7 under the authority granted to it under Section 133 of the Nuclear Waste Policy Act of 1982, as amended, 42 U.S.C. 10153. Section 72.7 allows the NRC to grant exemptions from the requirements of 10 CFR Part 72. Granting the licensee's proposed exemption provides adequate protection to public health and safety, and the environment. As explained below, the proposed exemption will not endanger life or property, or the common defense and security, and is otherwise in the public interest. Therefore, the exemption is authorized by law.

Will Not Endanger Life or Property or the Common Defense and Security

The provisions in 10 CFR 72.212(a) specifically state that the general licensee is limited to spent fuel that the general licensee is authorized to possess at the site under the specific license for the site. Sections 72.212(b)(3) and 72.212(b)(11) require the general licensee to store spent fuel in cask models approved under the provisions of 10 CFR Part 72 (which are listed in 10 CFR 72.214) and require general licensees to comply with the terms and conditions of the CoC for the approved cask model that is used. The requested exemption would allow the licensee to continue to store seven DSCs (loaded with spent nuclear fuel assemblies having decay heat exceeding the limits required by CoC No. 1030, Amendment No. 0 at the time of loading) in their as-loaded configuration at the North Anna Power Station ISFSI.

Currently, the twelve affected fuel assemblies have been in storage for a minimum of 1.3 years and have decayed to meet the required decay heat limits of the CoC. The licensee submitted TN Calculation No. 10494-174, which performed a bounding thermal analysis using ANSYS finite element software to evaluate the misloading events. The ANSYS analysis consists of a half-symmetric, three-dimensional model of a 32PTH DSC with a number of conservative assumptions. First, the modeled fuel assembly loading pattern is based on the configuration that resulted in the maximum fuel cladding temperature presented in the UFSAR analysis dated October 2, 2009, with the exception that the two fuel assemblies in Zone 1b were set to 860 W. The licensee states this configuration bounds the design zone limits as listed in TS, Section 2.1, which are based on each Zone 1b fuel assemblies being 800 W. It also

bounds the as-loaded configurations, where one or both fuel assemblies in Zone 1b exceeded a decay heat of 800 W, up to a value of 859 W. The remaining DSC fuel assembly decay heats were within the design basis. Therefore, since the as-loaded configuration had a total DSC decay heat of 31.167 kW, the licensee states the model conservatively assumes a total DSC decay heat of 34.92 kW. Secondly, the licensee applies a storage condition ambient temperature of 115°F, which is above the maximum normal storage ambient temperature of 100°F. The NRC staff finds the assumed 115°F boundary condition provides a reasonably conservative ambient temperature choice, considering that summer temperatures often are greater than 90°F and can reach 100°F (per weather almanac, www.NOAA.gov). The NRC staff further finds that applying a higher ambient temperature boundary condition also mitigates the thermal effects of other ambient weather conditions, such as wind direction relative to the DSC's inlet and outlet openings.

Using the conservative assumptions stated above, the TN Calculation No. 10494-174 analysis presented by the licensee indicates a maximum cladding temperature of 689°F for the as loaded DSC with the reversed heat load zoning for storage conditions. This is 5°F higher than the previously calculated cladding temperature found in Table 4-2 of the UFSAR. The temperatures of other DSC components increased by less than 5°F. The temperature increases due to the misloaded fuel assemblies are essentially unchanged for transfer conditions. By applying an additional 5°F to the previously calculated temperature for transfer conditions listed in Table 4-1 of the UFSAR, the licensee estimates that the maximum fuel cladding temperature for the as-loaded DSC with the reversed heat load zoning for transfer conditions to be 724°F. As a result, the licensee concluded that the maximum cladding temperatures for both normal storage and transfer conditions were below the 752°F maximum allowable cladding temperature limit noted in the UFSAR analysis. The NRC staff has reviewed the analysis presented by

Dominion and finds the thermal effect of the misloaded fuel assemblies to be minimal, and that the thermal margins were sufficient to mitigate the effects of the misloaded fuel assemblies so as to provide adequate heat removal capabilities when the DSC fuel assembly arrangement was not within the design basis. This thermal evaluation provides reasonable assurance that the TN NUHOMS® HD Storage System (HD-32PTH) loaded with fuel assemblies exceeding the decay heat limits allowed by the CoC will allow for continued safe storage of the spent fuel.

The licensee also discusses structural and pressure considerations due to the increased decay heat of the Zone 1b fuel assemblies. The licensee concludes that the increased decay heat did not have an effect on the structural evaluation since the DSC fuel compartment and basket rails are at temperatures below those considered in the design basis analysis. The submitted analysis finds that the 5°F higher temperature, due to the larger as-loaded decay heat, would result in a DSC pressure increase of 0.1 psig. The resulting 6 psig and 6.5 psig DSC pressures for the normal storage and transfer conditions were less than the 15 psig design basis pressure. The NRC staff has reviewed the analysis submitted in the exemption request and finds that there were no structural implications on the cask system resulting from the misloaded fuel assemblies.

The licensee verified the design basis shielding analysis remained bounding for the as-loaded DSCs. The licensee concluded the design basis shielding analysis assumes a DSC loading of 32 assemblies all having source terms applicable to assemblies generating 1.5 kW of decay heat and, therefore, bounds the as-loaded DSCs. The NRC staff has reviewed the design basis shielding analysis and concludes that the design remains bounding for the as-loaded DSCs and the radiation protection system of the NUHOMS® HD-32PTH dry cask storage system remains in compliance with 10 CFR Part 72.

The NRC staff has reviewed Dominion's exemption request and finds that the twelve fuel assemblies loaded into seven DSCs with decay heat greater than specified in the CoC do not affect the heat removal capabilities, the structural integrity, or the radiation protection system of the cask systems. Therefore, the NRC staff concludes that the exemption to allow the licensee to store the seven DSCs in their as-loaded configuration does not pose an increased risk to public health and safety or the common defense or security.

Otherwise in the Public Interest

The information Dominion submitted with its exemption request and the TN analysis documented in TN Calculation No. 10494-174 demonstrate that the as-loaded DSCs are not compromised due to the misloaded fuel assemblies. Dominion has also considered alternative action to correct the condition by reloading the affected DSCs to be in compliance with CoC No. 1030. This would involve retrieving each of the DSCs from their Horizontal Storage

Modules (HSM), unloading the spent fuel assemblies from the DSC, performing inspections of various DSC components, reloading the spent fuel assemblies into the used DSC or a new DSC (if there was damage noted on the used DSC) in accordance with CoC No. 1030, performing the DSC closing procedures, and transferring the DSC back to the ISFSI for re-insertion into the HSM.

The licensee estimates this alternative action of loading and unloading operations would increase personnel exposures by 250 mRem per affected DSC. In addition, the licensee also states the alternative to the proposed action would generate radioactive contaminated material and waste during loading and unloading operations and disposal of the used DSCs (if the DSCs were damaged during the unloading process). The licensee estimates the alternative to the proposed action would cost an estimated \$300,000 for unloading and reloading operations of each affected DSC and also necessitate additional fuel handling operations. If the DSC was damaged during unloading, the licensee estimates an additional \$1,000,000 for purchase of a new DSC and \$200,000 for disposal of the used DSC.

The exemption, by allowing the seven affected DSCs to remain in their as-loaded condition, is consistent with NRC's mission to protect public health and safety. Approving the DSCs to remain in their as-loaded condition results in less of an opportunity for a release of radioactive material than the alternative to the proposed action. Therefore, the exemption is in the public interest.

Environmental Consideration

The NRC staff also considered in the review of this exemption request whether there would be any significant environmental impacts associated with the exemption. For this proposed action, the NRC staff performed an environmental assessment pursuant to 10 CFR 51.30. The proposed action is the approval of a request for a one-time exemption from the requirements of 10 CFR 72.212(b)(3) and the portion of 72.212(b)(11), which requires compliance with the terms, conditions, and specifications of a CoC, but only to the extent necessary to allow Dominion to store the seven DSCs in the current as-loaded configuration at the North Anna Power Station ISFSI.

The NRC staff determined that the proposed action will not significantly impact the quality of the human environment. The NRC staff concludes that there are no changes being made in the types or amounts of any radiological effluents that may be released offsite, and there is no significant increase in occupational or public radiation exposure as a result of the proposed action. In addition the proposed action only affects the requirements associated with the fuel assemblies already loaded into the casks and does not affect non-radiological plant effluents, or any other aspects of the environment. The Environmental Assessment and the Finding of No Significant Impact are documented in the *Federal Register* (77 FR 20438, dated April 4, 2012).

4.0 CONCLUSION

Based on the foregoing considerations, the NRC has determined, pursuant to 10 CFR 72.7, that the exemption is authorized by law, will not endanger life or property or the common defense and security, and is otherwise in the public interest. Therefore, the NRC grants Dominion a one-time exemption from the requirements in 10 CFR 72.212(b)(3) and from the portion of 10 CFR 72.212(b)(11) that states the licensee shall comply with the terms, conditions, and specifications of the CoC for TN NUHOMS® HD dry cask storage system with DSCs serial numbers DOM-32PTH-004-C, -005-C, -007-C, -010-C, -013-C, -019-C and GBC-32PTH-011-C at the North Anna Power Station ISFSI.

This exemption is effective upon issuance.

Dated at Rockville, Maryland, this 12th day of April 2012.

FOR THE NUCLEAR REGULATORY COMMISSION

/RA/

Douglas Weaver, Deputy Director

Division of Spent Fuel Storage and Transportation

Office of Nuclear Material Safety

and Safeguards